Flood Early Warning System Operational Procedures

Contents

FEWS Operating Procedures
Draft – March 10, 2014

Introduction

The Flood Early Warning System (FEWS) group has been part of the Watershed Protection Department since the mid-1980s. It started within the Public Works Department as a group of volunteers who were assigned to monitor locations of creeks near to their homes. Readings of creeks were called in by land based telephone lines. In the 1990s until 2005, the FEWS program included staff members from all of the Watershed Engineering Division. Then, in 2005, the FEWS program formed and was staffed with 3.5 FTEs. From that point, FEWS personnel staffed the functions of the FEWS program with 4 staff members. While some of the members have changed over the past 10 years, the bulk of the duties of FEWS personnel have remained the same.

This document provides information on the Operating Procedures for FEWS.

Standby duty

The FEWS is continuously monitored 24/7/365. This duty is shared between four people.

Calendar and staff

In November, with input from all four FEWS staff members, an On-Call calendar is created and is maintained by shared calendar within the City's Outlook. This includes the duty list for both Primary and Backup Duty. Each shift of duty – whether Primary or Backup is for a period of 2 weeks starting from Monday morning at 8:00 am and continuing until the Monday two weeks from the start date. The calendar is found in the Shared Calendars and it is called, "WPD FEWS On Call Calendar." This staffing guarantees full time coverage of the system.

Because there are only four members of FEWS, this requires them to be in town (able to relocate to Homeland Security and Emergency Management (HSEM) Emergency Operations Center (EOC) within one hour of activation) and active approximately 50% of the year. Therefore, a certain amount of flexibility is built into their schedule and there can be slight variations within the 2 week period. In addition, during very severe storms or during CTECC activations, all four FEWS staff members are present. In general, they are present during the entire storm event.

Definition of a storm event

A storm event is described as follows:

1. Monitoring rainfall when it is within the Central Texas area -- the purpose of this is to determine the timing of storm and the intensity of the storm;
2. Activating the FEWS staff and the Field Operations for possible road closures – this is generally timed to be within 1.5 hours of the storm entering into Travis County to hopefully provide safe access for personnel;
3. Mobilization during the rain event; and
4. Monitoring and updating www.atxfloods.com when roads are open after the event has passed.

Definition of primary and backup duty

Primary Duty – The FEWS Primary Duty staff member has the following responsibilities:

1. Monitoring the weather;
2. Notifying Field Operations in the event of inclement weather within the next 24 to 48 hours;
3. Notifying Field Operations for mobilization;
4. Coordinating with HSEM when inclement weather approaches;
5. Responding to any requests from 311, HSEM, or AFD;
6. Keeping a pager and cell phone on person AT ALL TIMES;
7. Communicating with FEWS Backup Duty staff member when necessary;
8. Making the first call for activation of the FEWS area located within OTC; and
9. Being fit for duty to respond to any inclement weather.

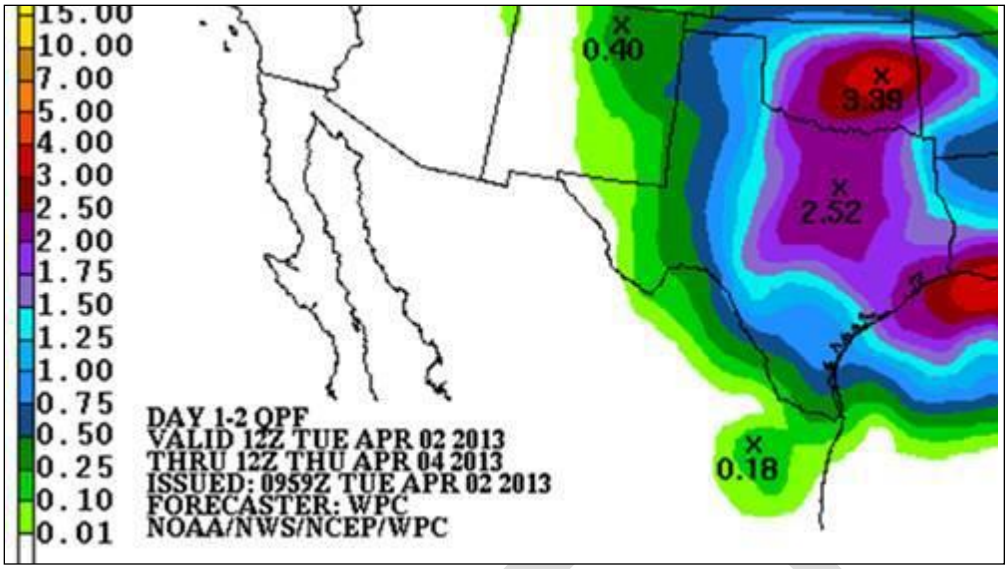
Backup Duty – The FEWS Backup Duty staff member has the following responsibilities:

1. Keeping a pager and cell phone on person AT ALL TIMES;
2. Communicating with the FEWS Primary Operator if alerted by pager or cell phone;
3. Responding to FEWS area located within OTC when activated; and
4. Being fit for duty to respond to any inclement weather.

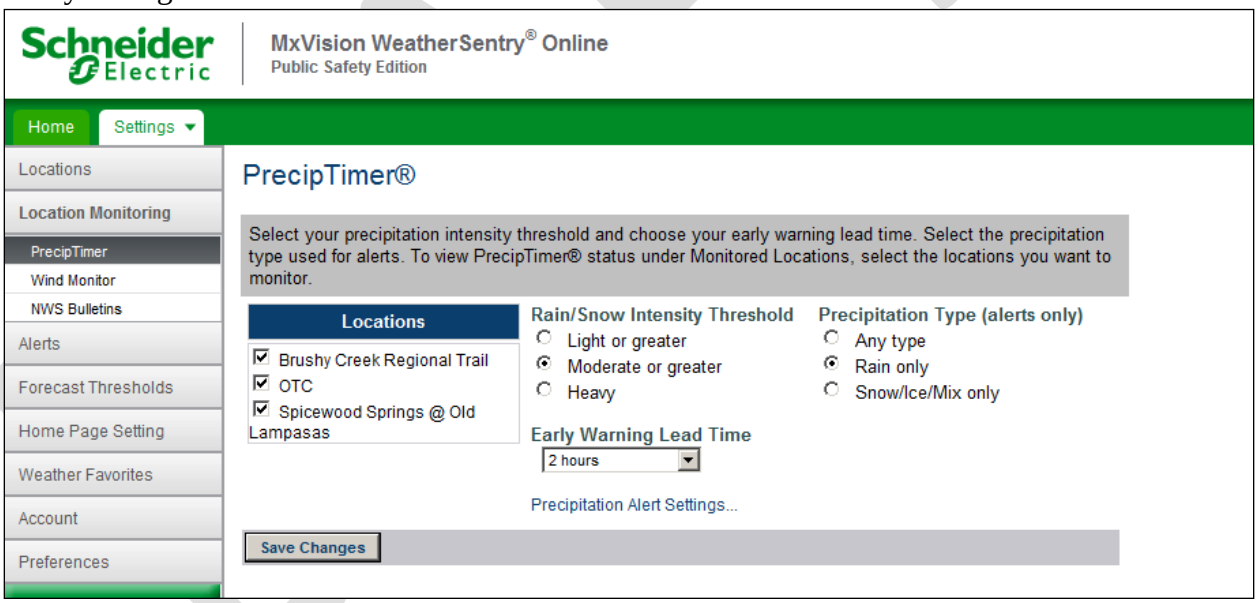
When standby becomes on-call status

One of the primary responsibilities of the FEWS is to monitor the weather including weather short term and long range forecasts. Monitoring the weather is a daily task of FEWS, and it is the determining factor used to increase awareness ahead of a severe storm. Weather monitoring is completed in several different steps and uses several different types of software and services. They are as follows:

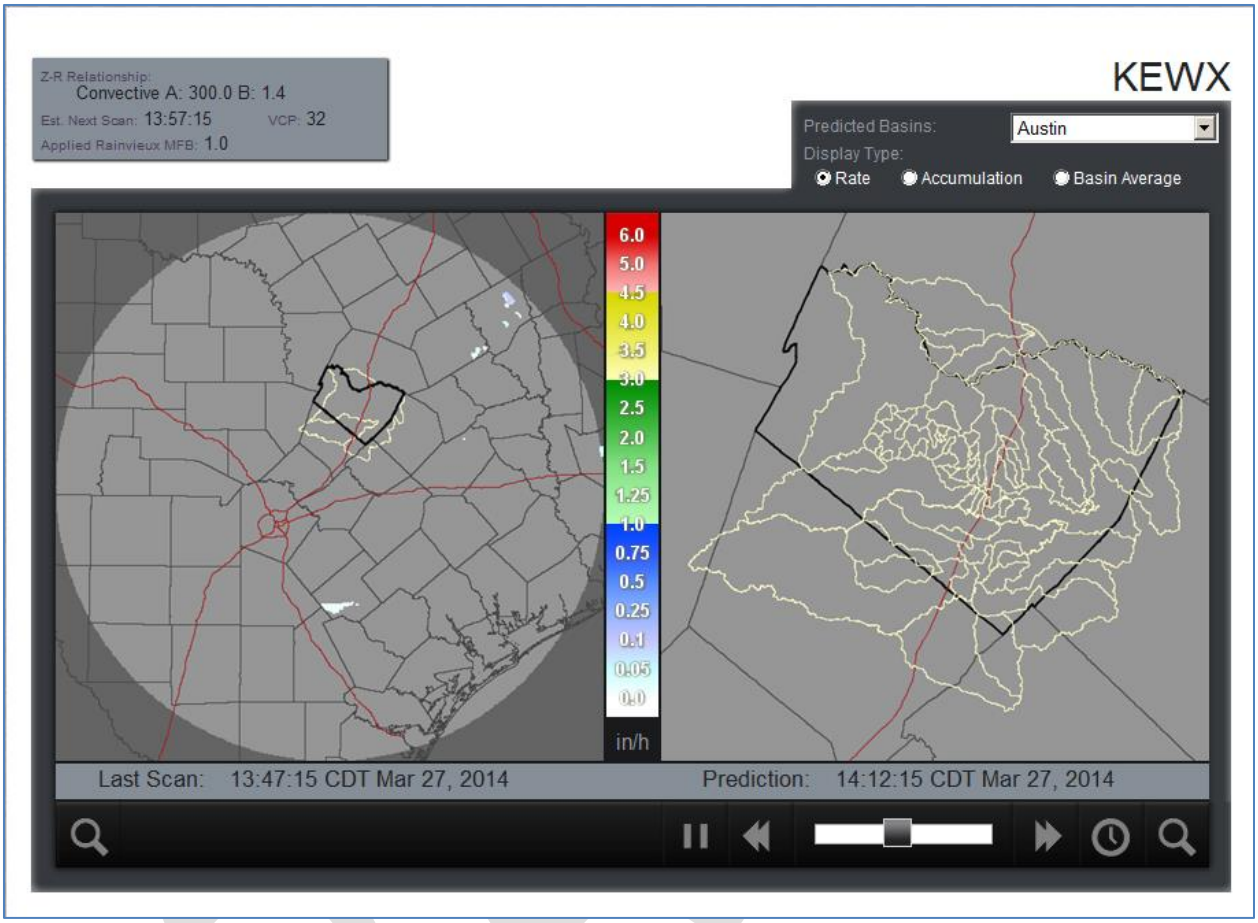
1. National Weather Service Forecasts – FEWS relies on the National Weather Service for all forecasts. While forecasts from the local media are often looked at, reliance is primarily on the NWS EWX Forecast Office located in New Braunfels, Texas. In addition, for more significant events, FEWS will work with HSEM and with the NWS directly to obtain specific forecasts for the Travis County area.
2. Pre-emptive planning for future activations comes from information obtained from the National Weather Service Quantitative Precipitation Forecasts – these are spatial rainfall predictions up to 7 days in the future and from the National Weather Service Severe Storm Prediction Center – these forecasts of severe weather are made 3 days in the future. Below is a screen shot of a forecast made by the NWS.



3. Private sentry weather service – This software service – MxVision Weather Sentry -- provides a pager alert in the event of precipitation greater than one-inch per hour is forecasted to be within Travis County within two hours. Below is a screenshot of the sentry settings.



4. PreVieux sentry alarms – The Rainvieux gauge adjusted radar rainfall program also has a predicted rainfall that is tied directly to either the EWX or GRK NEXRAD Doppler. These automated pager alarms will send a pager alert in the event that basin averaged rainfall greater than one inch is forecasted within the next hour. Below is a screenshot of the predicted rainfall.



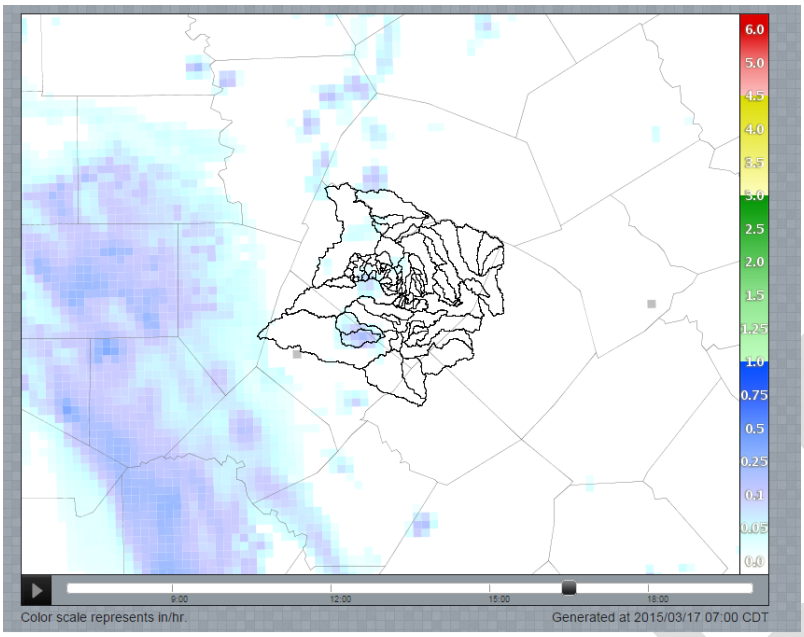
The watershed boundaries seen on the left side of the screen are the forecasted areas. For example, if any of those watersheds are predicted to receive greater than one inch within the next one hour, a pager alarm will be sent. Please note that the threshold basin averaged one-inch per hour or more is selected because this is when the low water crossings will close.

Once it becomes necessary to monitor weather based on the initial page, then the Primary Duty FEWS staff member becomes ACTIVATED. Once it becomes necessary to initiate calls with Field Operations to start mobilization for barricade operations, then the Secondary FEWS staff member becomes ACTIVATED.

During severe storms, ALL FEWS STAFF MEMBERS ARE ACTIVATED. In general, this is for the duration of the event – regardless of the time.

Use of the NWS High Resolution Rapid Refresh Model (HRRR)

As of September 1, 2014 the National Weather Service publishes a high resolution rainfall forecast that provides detailed rainfall forecasts for up to 12 hours out. There is a digital and spatial file behind the forecast that allows for the running of the Vflo (FEWS forecast models). In the event of the forecast of rainfall, FEWS checks this model and the model outputs to aid them in the decision of early activation of Field Operations staff.



HRRR Generation at 07:00 for 16:30

FEWS Forecast Model 12 hour Predictions

Pager policy

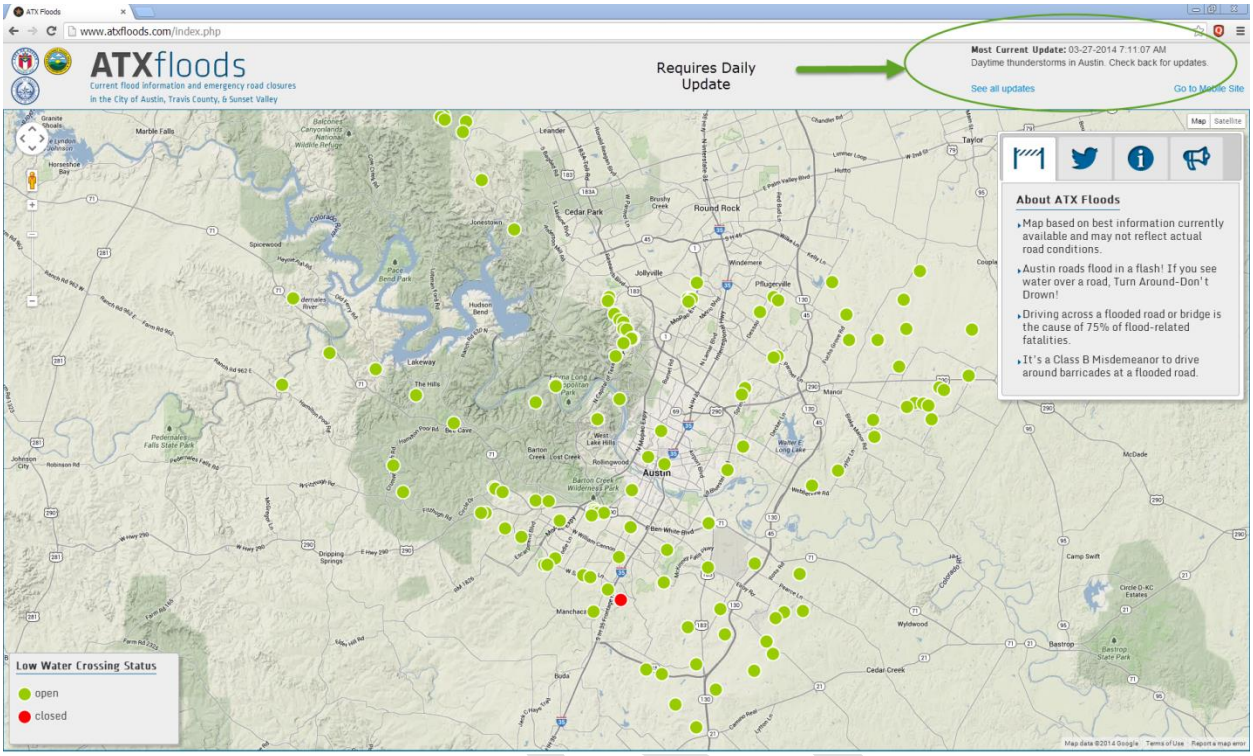
All FEWS staff have pagers that have a single number. It is 512-101-0197. This pager number is used by 311, AFD and APD dispatch, and by HSEM in the event of an activation. This way, there is no reliance on a specific FEWS individual. Rather, all FEWS operators receive the same information.

Again, pagers and cell phones have to be ON AT ALL TIMES for the FEWS Primary and Backup staff members.

Update www.ATXfloods.com

ATXfloods.com is a website purchased, developed, and maintained by FEWS. The web address is www.ATXfloods.com. There is a desktop version, a mobile version, and an XML feed from

this web address. The updates include updating the tag at the top of the screen. Below is a screenshot taken from the website.



Daily standby duties

Ensure all systems are operational

There are a multiple number of systems that have to be operational at all times. The list is as follows:

1. Ensure that EVENTS (telemetry of gauges, flashing, lights, and gate arms) is communicating;
2. Ensure that flashing lights and gate arms are operating normally (no power issues or loss of communications);
3. Ensure that data transfer between EVENTS and the archive database, SHEF file for gauge adjusted radar vendor user, and FloodPro are operational.
4. Ensure that LCRA Hydromet data is received by gauge adjusted radar rainfall vendor is operational;
5. Ensure that traffic cameras in OTC are operational; and
6. Ensure that webforecast map server is operational.

Read and interpret weather forecasts

There are a number of weather forecasts that were listed above. Again, these include the following:

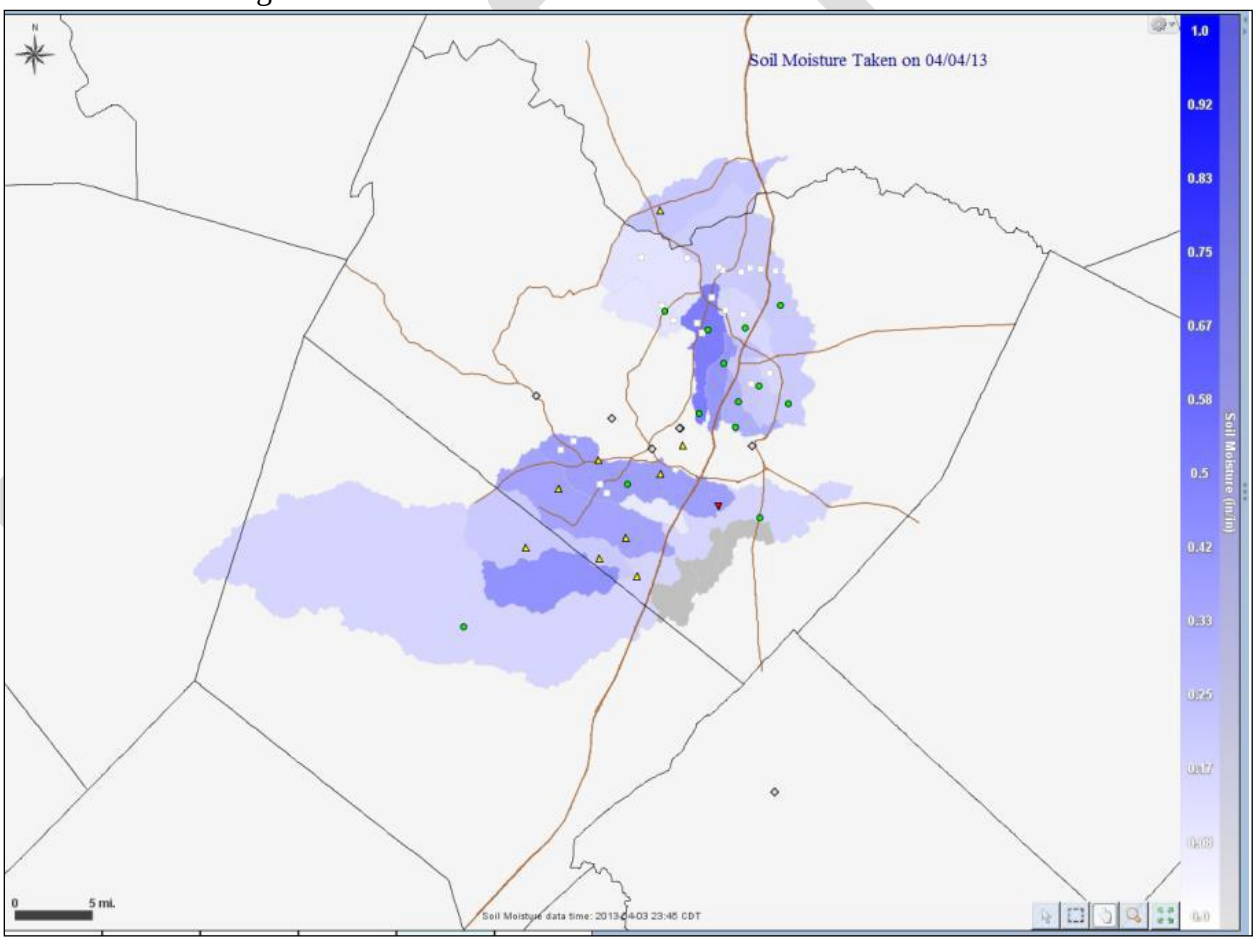
1. NWS Forecasts (EWX, QPF, SSPC)
2. MxWeather Sentry site
3. Media

Respond to 3-1-1 calls
Occasionally due to lightning strikes, vehicular accidents, vandalizing, or localized power outages, the gates and lights will malfunction. If called into 311, they will in turn call the FEWS Primary Pager number. The duty of the Primary FEWS staff member is to respond to the pager and work with resources available at the time to fix the problem. The first priority is that if the device is blocking traffic, it shall be removed as quickly as possible. Very often, this involves contacting Field Operations for help.

On-call duties – weather imminent

The threshold for imminent weather is based on the following:

1. Forecasts NWS or from MxWeather Sentry that rainfall amounts will exceed one inch in 24 hours; or
2. Forecasts from NWS or from MxWeather Sentry that moderate rain will occur greater than 48 hours; or
3. Based on soil moistures that exceed 30% in one of the Austin watersheds. Below is a screenshot indicating soil moisture.



FEWS monitors modeled soil moisture. This is calculated from the forecast models and the daily evapotranspiration amount every 24 hours.

Monitoring the weather

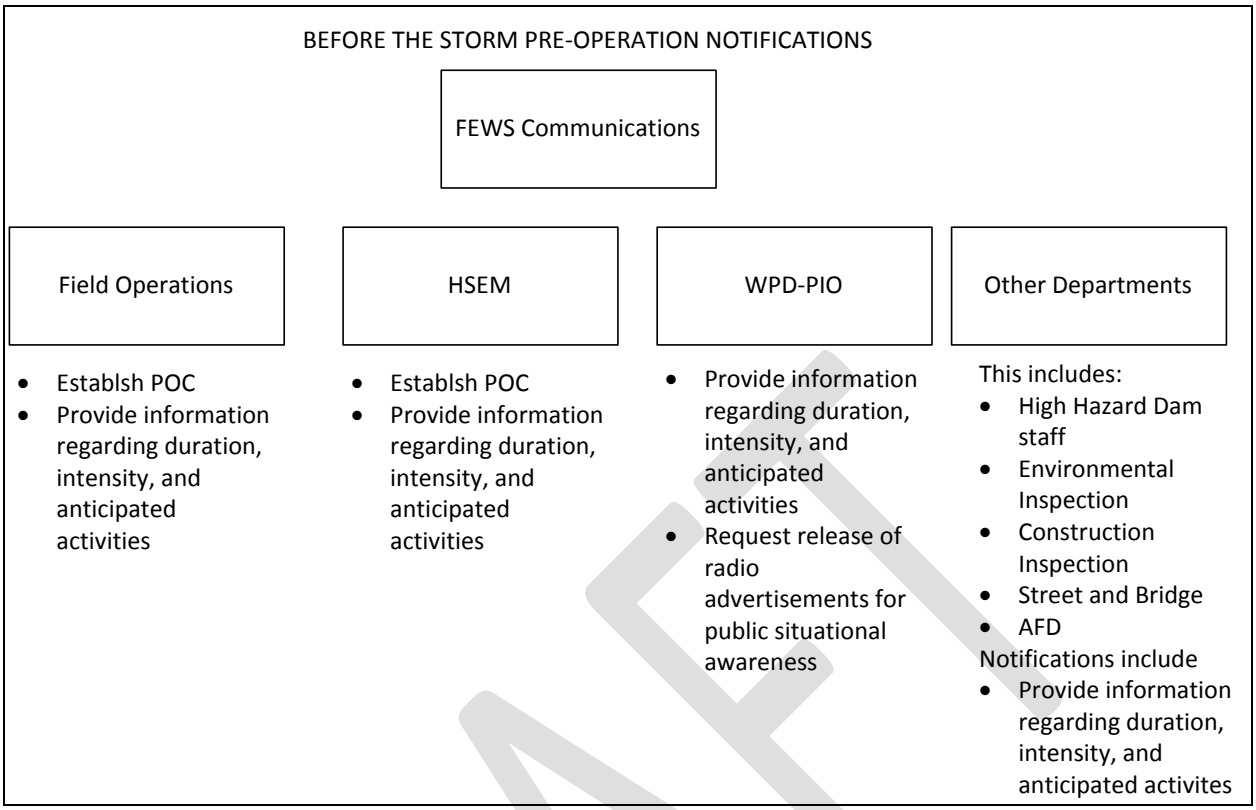
In the event that inclement weather is forecasted, FEWS will increase observation of weather programs mentioned earlier. In addition, FEWS will coordinate with the following groups:

1. Field Operations Division for the possibility of the action. Information provided includes the type of rain event, the amount of rain forecasted, how long the event may last, and what are the potential outcomes (out of channel conditions or known low water crossing closures). This also establishes contact with the staff member in Field Operations who will be considered the Single Point of Contact during the storm event.
2. Public Works Construction Inspection – especially for the Waller Creek Tunnel Project and for the Boardwalk Construction Project; and
3. HSEM for the possibility of road closures.

If heavier rain is anticipated, then in addition to the above groups, FEWS will also notify the following:

1. High Hazard Dam group;
2. Request from the PIO group a release of a pre-emptive radio advertisement for public awareness of the potential of severe weather;
3. Coordination with Construction Inspection as well as Environmental Inspection for the possible removal of filter dikes across inlets.
4. Notification to ATXFloods partners to enter roads that are closed due to flooding.
5. If the storm takes place during daylight hours and business hours, FEWS will ask other staff members within WED and FOD to take photographs during the rain storm, if it safe to do so.

The following is a chart indicating the communications made prior to the storm.



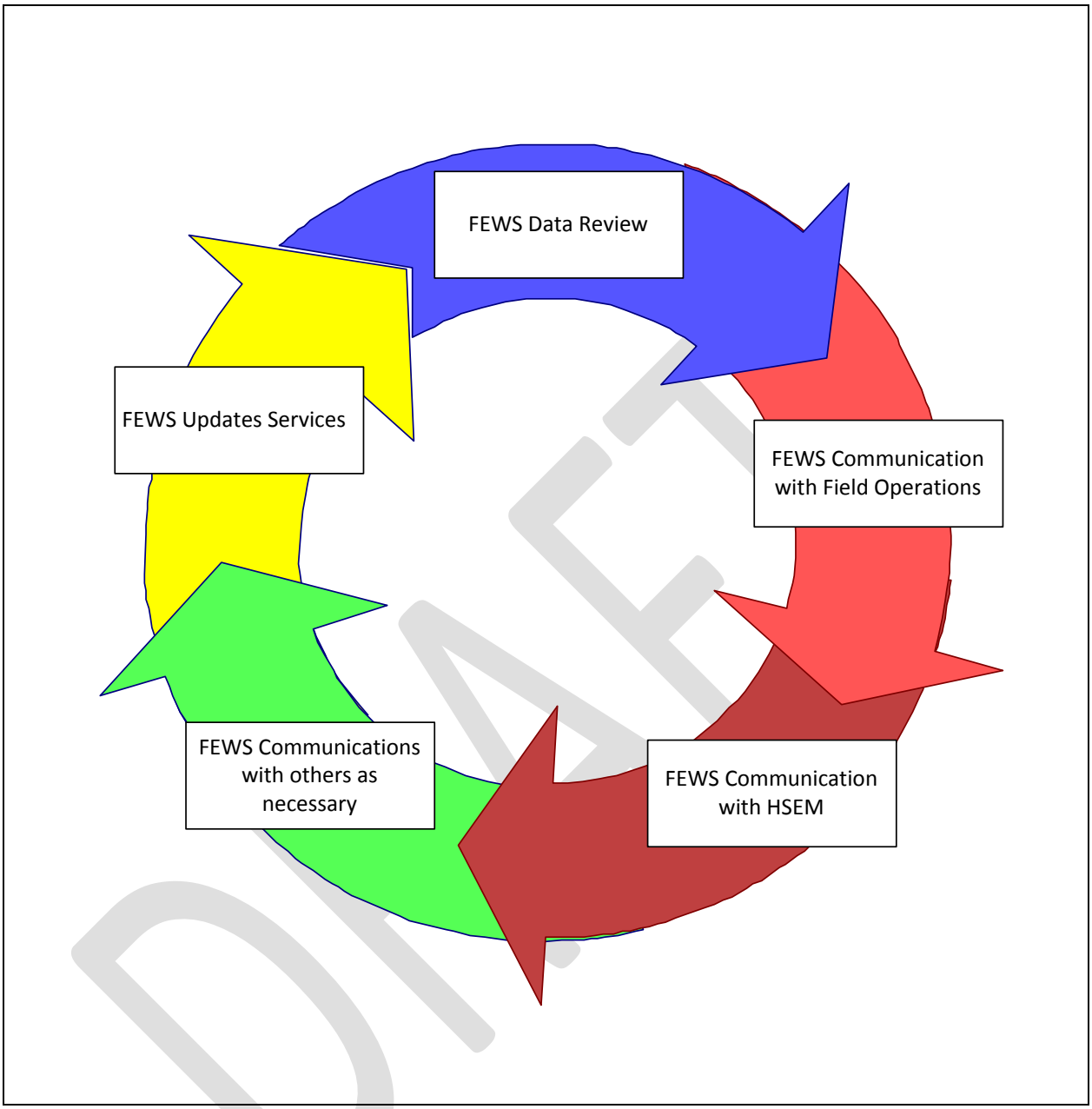
Update ATXfloods.com

www.ATXfloods.com will also be updated to provide the initial notification that inclement weather is forecasted.

FEWS activation duties

Flowchart of FEWS activities during a storm

Below is a general description of FEWS activities during a storm. Note that the cycle continues until the event is over and ALL ROADS are OPEN. During very heavy storms, this cycle is repeated multiple times every minute. Often, it is repeated by different FEWS staff members who are looking at different areas of Austin. The cycle is initiated by first looking at all of the FEWS data sources, communicating with Field Operations, then passing on information to HSEM and others as necessary, and then if an action is taken, then the public facing website --- www.atxfloods.com will be updated.



Note that this cycle continues until the all roads are OPEN. This is because the public website must be updated at all times.

FEWS Data Review	• FEWS SCADA • Rainvieux and Previeux • GRLevel 3 • EVENTS SCADA • iNWS • USGS • Forecast Map • AFD CAD – for information related to swift water rescues • WPD Field Operations Radio – for information on inlet clogs, notification of localized flooding, and observations on creek levels
FEWS Communication with Field Operations	• Notification of road closure due to automated alert • Provides direction of observation based on path and speed of storm or on other forecast • Requests information on whether to stand by or continue moving
FEWS Communication with HSEM	• Notification of first road closure by phone • 512-974-0600 • Then after initial contact on closure, decide how best to communicate
FEWS Communications with others as necessary	• Communication with High Hazard Dam based on threat levels • Communications with Street and Bridge regarding need for assistance with closures • Communications with Construction Inspection with respect to specific construction projects located within creek flood zones
FEWS Updates Services	• ATXfloods.com • Sends initial notification of closure via ATXfloods.com/alerts • Updates NWS via NWSChat • Sends #atxfloods tweets regarding closures

Contact field operations Point of Contact

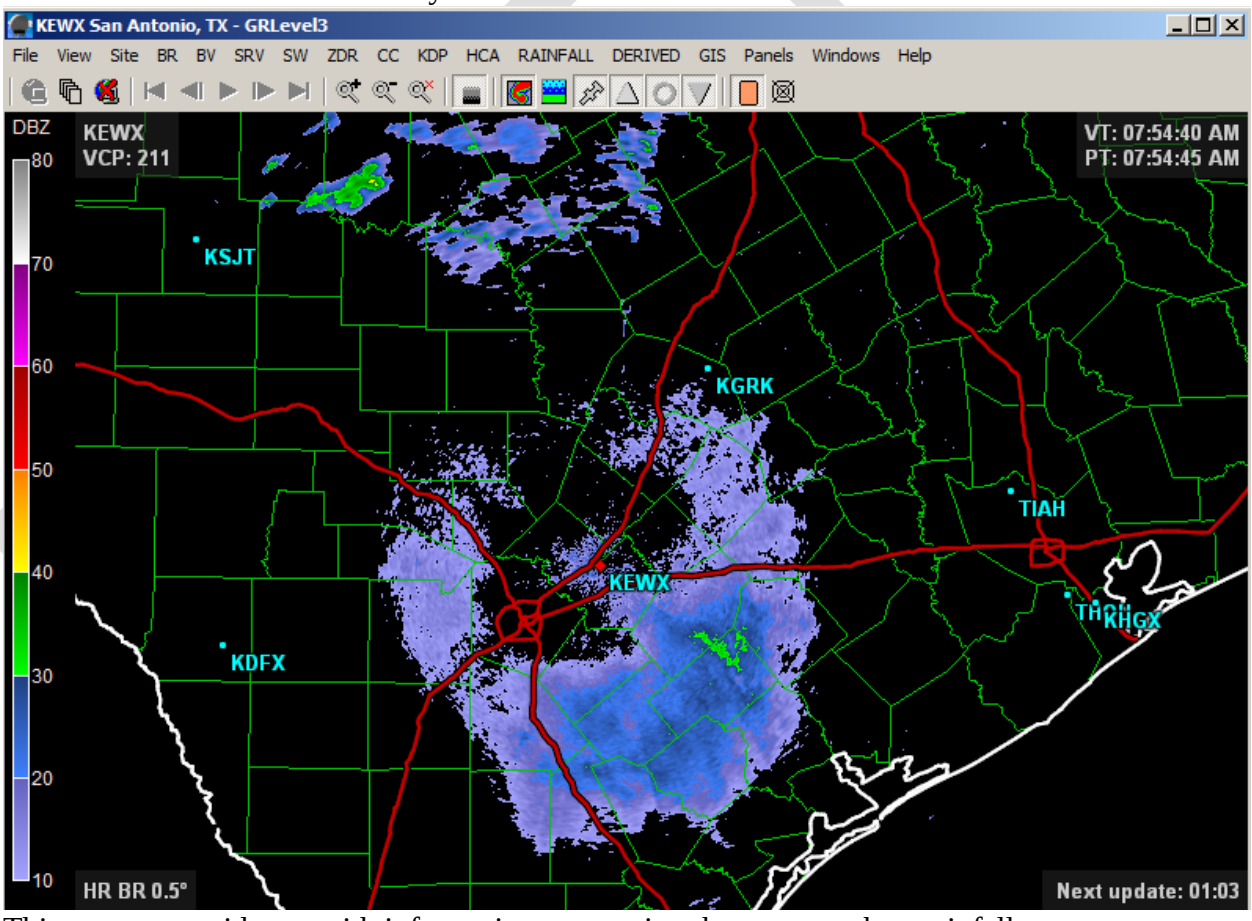
The Field Operations Open Waterways Superintendent is the Point of Contact for ALL FEWS items. This staff member is the first one contacted during activation, and FEWS is notified of who will be the point of contact from Field Operations during the event. In addition, discussion of the duration, timing, and forecasted effects of the storm are discussed with Field Operations. From there, Field Operations develops a staffing and resources plan. This information is conveyed to FEWS.

Throughout the storm event, FEWS communicates with Field Operations point of contact by way of radio.

FEWS Data

During the storm event, the following data are utilized:

1. GRLevel 3 – geospatial, site-specific radar data viewer from NWS NEXRAD facilities. Below is a screenshot from that system.



This system provides us with information concerning the storm such as rainfall rates (estimated from NEXRAD Doppler only); hail densities; storm velocities; cloud tops; and NWS watches and warnings. It will also include Storm Spotter information.

2. Rainvieux and Previeux – These private systems provide forecasted rain as well as 15 minute gauge adjusted radar rainfall. This system provides the following information:

a. 15 minute hyetographs on 4883 pixels that are one square kilometer;
b. Threat information per watershed based on average basin rainfall and time of concentration;
c. Links to KML files of return period storm events;
d. Upstream basin averages of High Hazard Dams – includes a pager audible alert based on thresholds established by the High Hazard Dam staff;
e. Upstream basin averages of USGS gauges;
f. Forecast model hydrographs are produced for over 600 forecast points within the City every 15 minutes;
g. Provides an XML script that is entered into the forecast mapping program;
h. Provides audible alerts tied to downtown watershed basin averages (provided for Public Works Construction Inspection);
i. Provides 12 hour forecasts based upon NWS HRRR; and
j. Keeps track of daily soil moisture within specific watersheds.

3. USGS Gauges – The City of Austin is a cooperating partner with the USGS and pays for the gauge maintenance and rating curve development of 28 gauges within the City of Austin area. These gauges serve as both warning gauges as well as calibration points for forecast models. For many gauges, the USGS relies on radio transmissions. Through the interlocal agreement with the USGS, they have installed an antenna on one of the City's owned transmission radio towers. This provides 5 minute data to the City which is passed on to the public via the City's public website.

   The USGS data is read every minute by City servers and is received by the FEWS SCADA system – EVENTS. In addition, FEWS operators have notification alarms tied to their cell phones that are based on flow rates. In the event a flow rate is exceeded, the cell phones of FEWS staff members will send a text and email message.

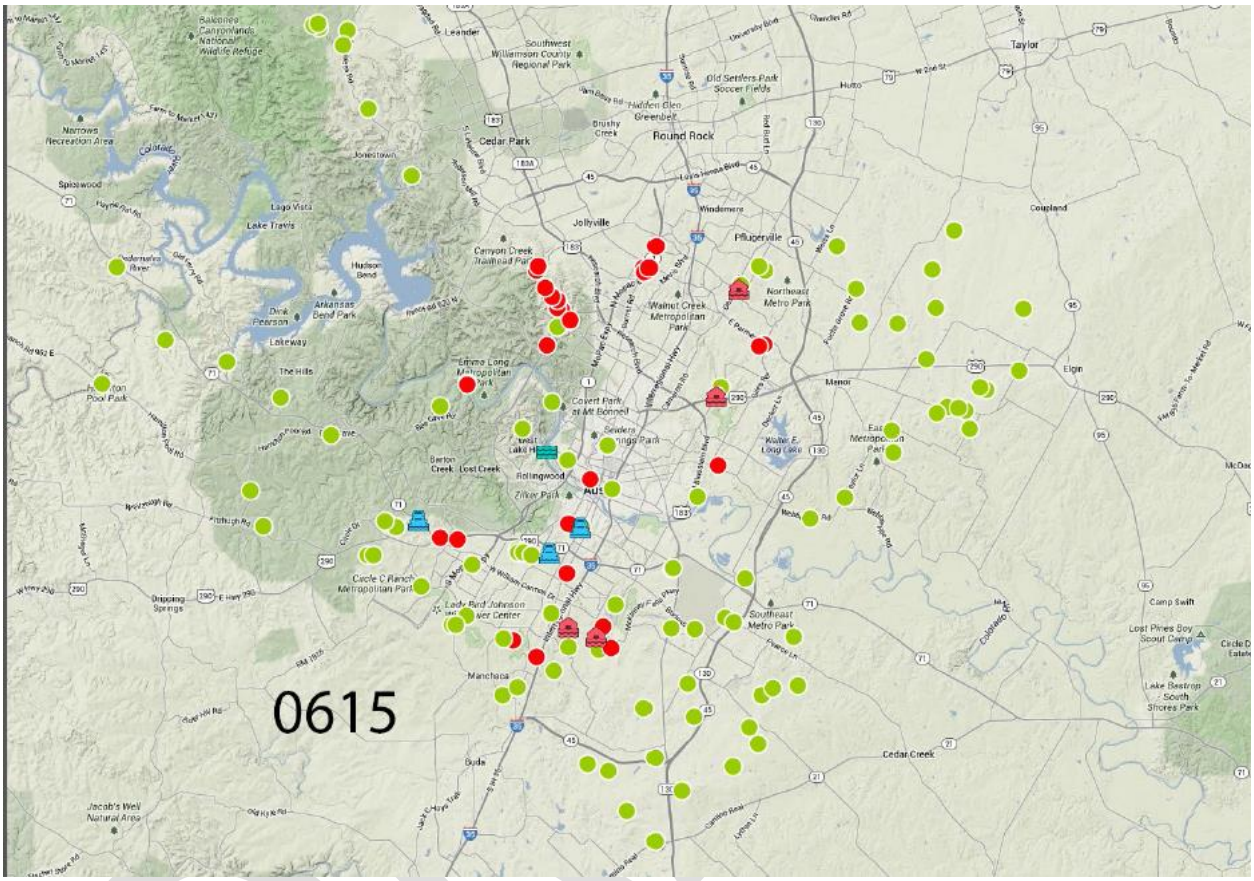
4. FEWS SCADA – EVENTS – Rain, stream level, and conditions of low water crossing gate arms and flashing lights is received into EVENTS. Low water crossing warnings are activated in several ways:
   a. Automatically based upon a float switch closure;
   b. At the site;
   c. By the SCADA; and
   d. By cellphone.

5. FEWS also updates www.ATXfloods.com for road closure information, AFD CAD information pertaining to swift water rescues, and any Field Operations closures based upon localized flooding. Note that this information is a public website, so this information is utilized by both the media as well as by the National Weather Service. This site is updated as closures or other actions take place. It is one of the most important tasks of FEWS staff because this is the location where the public obtains information.

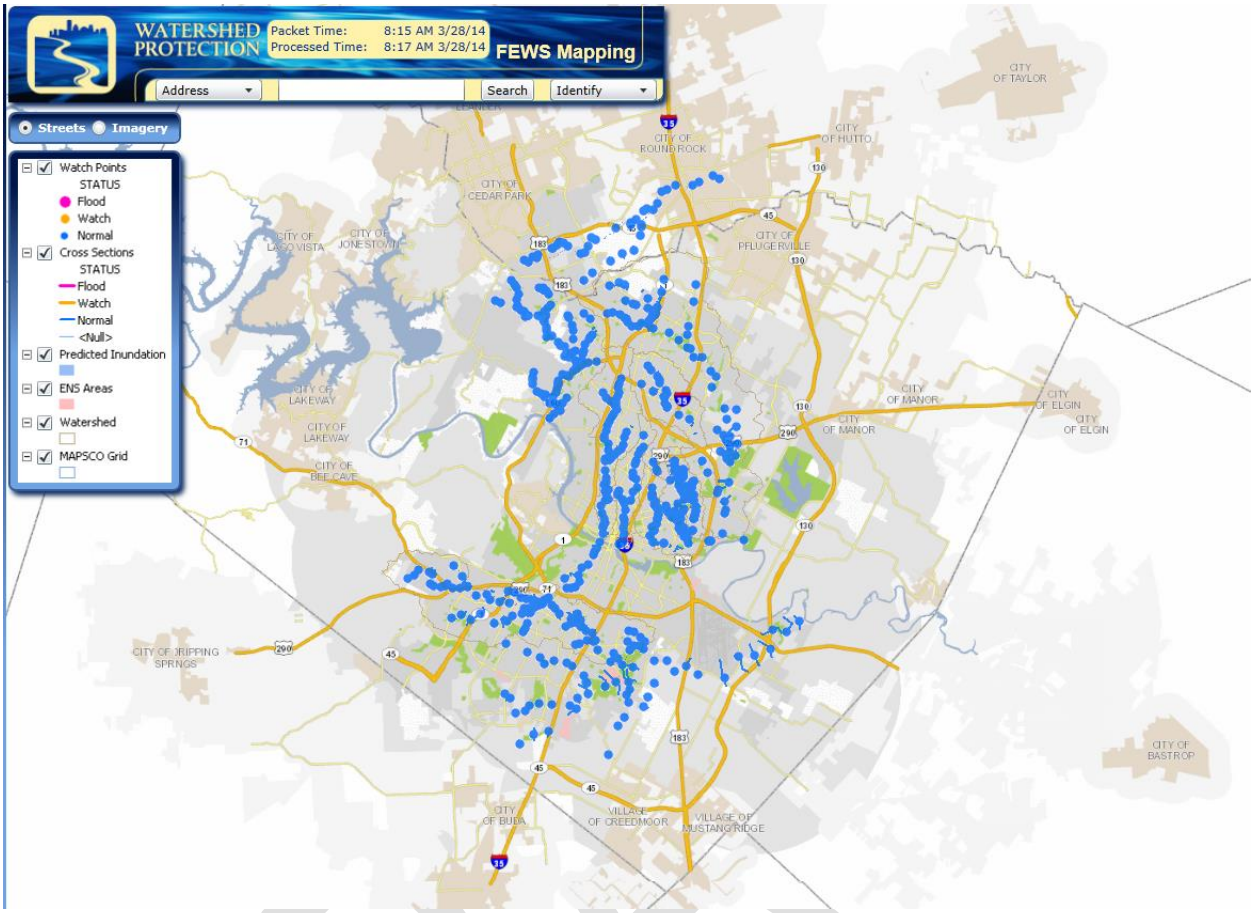
   In addition to the City of Austin being users of this site, other entities including Travis County and other surrounding counties and municipalities also enter information into this

site. Other City departments – such as Street and Bridge, AFD, and HSEM have access to mark information also.

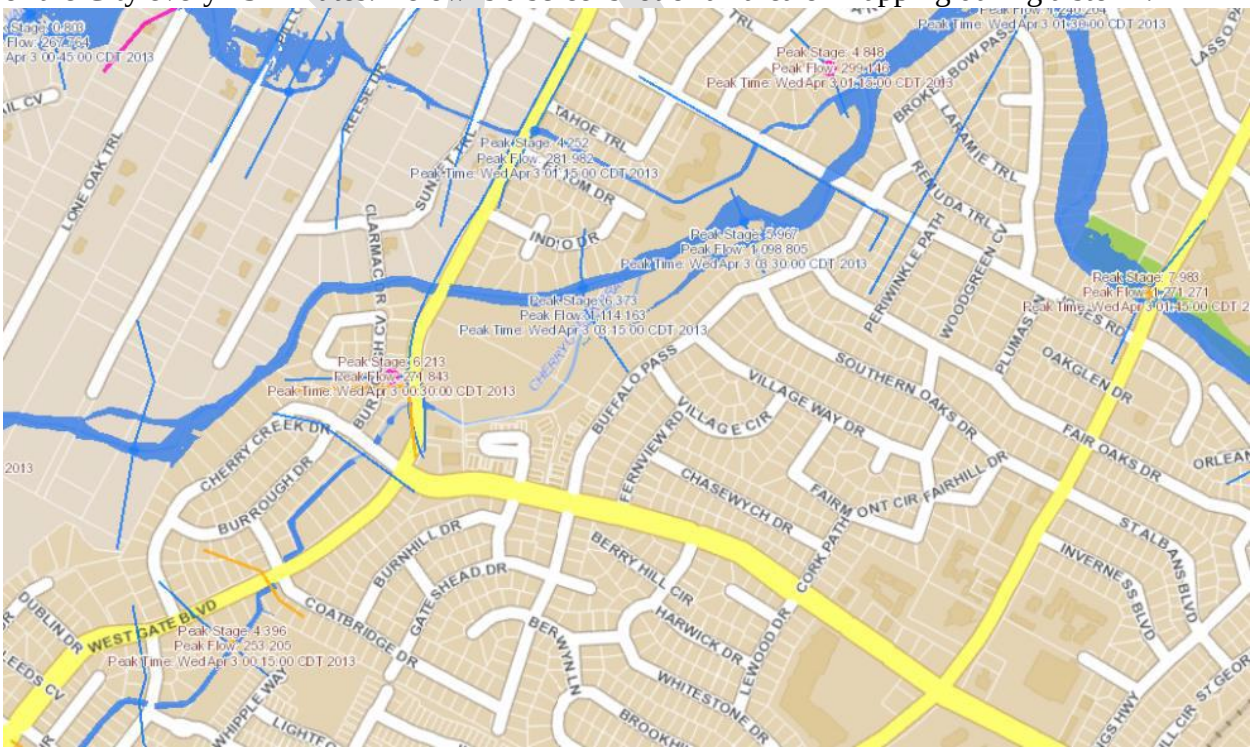
Below is a screen shot of www.ATXfloods.com that includes several of these related issues.



6. Forecast mapping – FEWS has an intranet site that provides forecasts at approximately 600 locations throughout the City. Below is a screenshot of that map. The blue dots are forecast points.



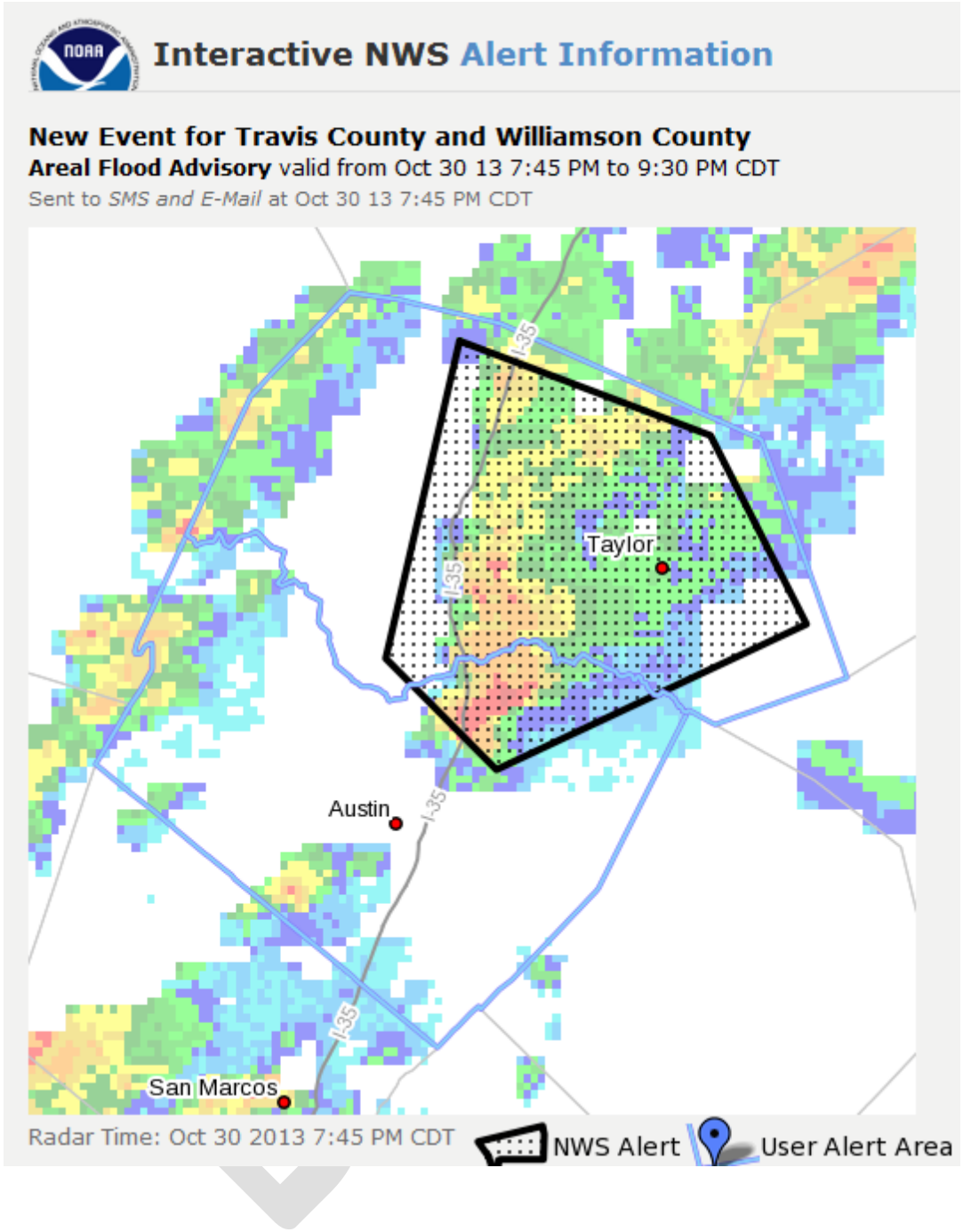
During storms, based upon FEWS previously defined thresholds, forecast maps can be produced of the City every 15 minutes. Below is a screenshot of an area of mapping during a storm.



7. NWSChat – FEWS communicates with the NWS as well as representatives from other agencies and the media by using NWS chat. Each FEWS staff has a log in for the chat room. During a storm event, the chat room is open for discussion.

8. First Call/AMATRA notification system – For those that have signed up on ATXfloods Alerts!, notifications of initial road closures and final road openings are texted and emailed. Below is a sample of what a notification would look like.

9. Other tools used – iNWS for cell phone messages regarding warnings. Below is a screenshot from iNWS.


Interactive NWS Alert Information
New Event for Travis County and Williamson County
Areal Flood Advisory valid from Oct 30 13 7:45 PM to 9:30 PM CDT
Sent to SMS and E-Mail at Oct 30 13 7:45 PM CDT
I-35
Taylor
I-35
Austin
I-35
I-35
San Marcos
Radar Time: Oct 30 2013 7:45 PM CDT
NWS Alert
User Alert Area

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000
WGUS84 KEWX 310045
FLSEWX

FLOOD ADVISORY
NATIONAL WEATHER SERVICE AUSTIN/SAN ANTONIO TX
745 PM CDT WED OCT 30 2013

TXC453-491-310230-
/O.NEW.KEWX.FA.Y.0118.131031T0045Z-131031T0230Z/
/00000.N.ER.000000T0000Z.000000T0000Z.000000T0000Z.OO/
TRAVIS-WILLIAMSON-
745 PM CDT WED OCT 30 2013

THE NATIONAL WEATHER SERVICE IN AUSTIN SAN ANTONIO HAS ISSUED AN

* URBAN AND SMALL STREAM FLOOD ADVISORY FOR...
  EAST CENTRAL TRAVIS COUNTY...
  EASTERN WILLIAMSON COUNTY...

* UNTIL 930 PM CDT

* AT 743 PM CDT...NATIONAL WEATHER SERVICE METEOROLOGISTS HAVE
  DETECTED THUNDERSTORMS WITH HEAVY RAINFALL ACROSS THE ADVISORY
  AREA. DOPPLER RADAR ESTIMATED ONE HALF INCH IN THE LAST 30 MINUTES
  AND STORM TOTAL AMOUNTS OF ONE AND ONE HALF INCHES.

* RUNOFF FROM THIS EXCESSIVE RAINFALL WILL CAUSE MINOR FLOODING TO
  OCCUR...ESPECIALLY ALONG SMALL STREAMS AND NEAR LOW WATER
  CROSSINGS. SOME LOCATIONS THAT WILL EXPERIENCE MINOR FLOODING
  INCLUDE...GEORGETOWN...GRANGER...PFLUGERVILLE...ROUND ROCK...
  SERENADA...TAYLOR...WINDEMERE...COUPLAND...GEORGETOWN DAM AND
  GRANGER DAM.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

BE ESPECIALLY CAUTIOUS AT NIGHT WHEN IT IS HARDER TO RECOGNIZE THE
DANGERS OF FLOODING. IF FLOODING IS OBSERVED ACT QUICKLY. DO NOT
DRIVE THROUGH AREAS WHERE WATER COVERS THE ROADWAY.

DO NOT DRIVE YOUR VEHICLE INTO AREAS WHERE THE WATER COVERS THE
ROADWAY. THE WATER DEPTH MAY BE TOO GREAT TO ALLOW YOUR CAR TO CROSS
SAFELY.

&&

LAT...LON 3085 9768 3074 9734 3052 9721 3035 9763
      3048 9778
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EOC activation

FEWS is designated within the Planning Section of the EOC. The decision on activating the EOC is made by City Management, HSEM, AFD, EMS, or APD. For a Level 1 activation, FEWS will report to the EOC. Otherwise, FEWS may report sooner to the EOC if there is a

potential for an activation. The decision for FEWS staff to report to the EOC is generally based upon the following criteria:

1. The storm is lengthening and intensifying;
2. Out of bank creek conditions are imminent; or
3. High level of swift water rescue information indicated in AFD CAD.

Should FEWS decide to relocate from OTC to EOC, then the HSEM Duty Officer is contacted. The HSEM Duty Officer has the prerogative on the decision to supply a limited activation of the EOC.

Transition FEWS staff from OTC to EOC

As decisions are made throughout a storm event that transitions to the EOC are imminent, there should be four FEWS staff members available. During that time, the Primary and Backup FEWS operators will move to the EOC first while the remaining two operators are at OTC. This keeps a smooth line of communication and storm response. Once FEWS staff members are at EOC, the remaining two staff members will then join them.

FEWS Responsibilities at the EOC

Once at the EOC, FEWS responsibilities continue as described above, however, FEWS now communicates either directly with HSEM or through WebEOC.

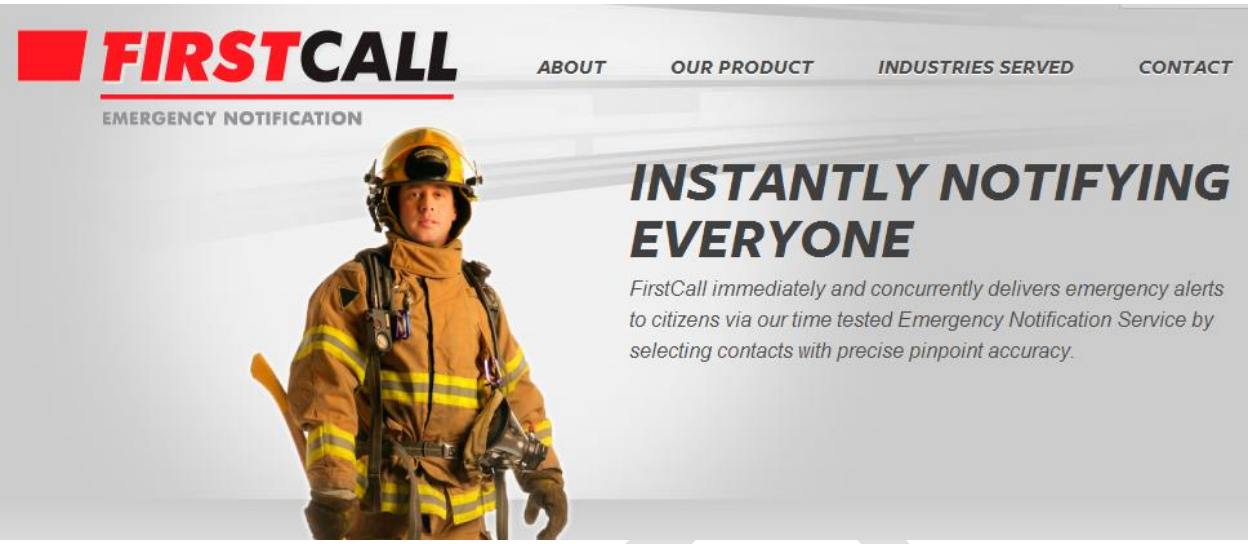
FEWS staff members are required to sign in at the EOC.

WebEOC is a web based communications portal. All FEWS staff members have user names and passwords into the system. As conditions with respect to road closures, creek flooding, or forecasts of creek flooding change, WebEOC is used to convey that information.

In the event of an evacuation due to flooding, First Call is utilized. This is public notification system that utilizes the City's 911 database. Only information regarding a definable action – such as an evacuation notice – can be used by this system. Note: FEWS CANNOT INITIATE A 911 CALL UNLESS APPROVED BY AFD or HSEM.

Below is a screenshot of FirstCall. FEWS Operators have access to the City of Austin account with User names and passwords. FEWS will only utilize First Call under two scenarios:

1. As situational awareness associated with ATXfloods Alerts!; or
2. As directed by HSEM or AFD in conjunction with a flood evacuation. Note that this will require the use of the 911 database and not the list database that is set up for ATXfloods Alerts!



Every hour during an activation, HSEM requires a verbal update from all parties present. FEWS participates in this update. The following information is conveyed:

1. Amount of rain to date and amount of rain anticipated;
2. Forecast conditions of creeks and areas impacted;
3. For flooding conditions provide information on number of homes effected as well as potential safe routes;
4. Anticipated time that flooding will occur based upon rainfall information to date; and
5. Notification of any resource related issues – technical or personnel driven.

This process continues until the event is over.

FEWS Responsibilities Immediately After Storm

FEWS has the following responsibilities immediately after the storm:

1. Ensures that all roads are able to be opened – in some cases this requires the additional assistance from the Street and Bridge Division. Note: ROADS ARE OPEN AFTER FIELD OPERATIONS STAFF INDICATE THAT ALL DEBRIS HAS BEEN REMOVED.
2. Coordinate the acquisition of high water marks;
3. Collect data from the storm including:
    a. Rainfall data;
    b. USGS gauge data;
    c. Photographs;
    d. Forecast model results;
    e. Forecast map results; and
    f. Analytics on www.ATXfloods.com.

Appendix A – ATXfloods Dashboard Instructions

Appendix B – Using FirstCall

Appendix C – Flood Plan Information

Flood Plan

- Edited polygons for 2 – 100 year for most creeks
- Alarm spreadsheets for EVENTS
- Depth of flooded structures and maps for the first and second priority areas.
- Spreadsheets associated with ENS areas
- AFD Maps
- Google earth KMLs in EVENTS
- Gauge height maps for Onion (should we make more?)
- Flood Protection Action Forms

  Forecast Maps (Rainfall + Forecast Rain)
  DDF in EvenTS

  Have project for estimation of depth of flooded structures.